2009 TRB Annual Meeting DVD
Papers related to ongoing WHRP projects

0092-08-07 Eval. of Intelligent Compaction Tech. for Densification of Roadway Subgrades and Structural Layers (Joint w/Geotech & Flex)

Applying Instrumented Rollers to Assess Construction Quality on Texas Projects Submitted for publication and presentation to the Transportation Research Board
Stephen Sebesta, Wenting Liu and Tom Scullion, Texas Transportation Institute
Paper Number: 09-1295
From: Abstract
The concept of using a vibratory compactor as a tool for assessing construction quality by measuring the drum displacement with an accelerometer began decades ago. Initiated in Europe and correlated with plate bearing tests, this technology has advanced to "intelligent" compaction where feedback from the instrumentation can control the amplitude of vibration. With the national push to implement such methods in the United States, researchers at the Texas Transportation Institute sought to examine the relationship between the vibration amplitude of the roller drum and pavement layer properties on several Texas construction projects. Testing revealed that, while the roller drum vibration amplitudes do relate to pavement layer properties, the correlation is with the stiffness of foundation layers, typically at least 12 inches below the surface. This presents significant hurdles to overcome in implementing the instrumented/intelligent compaction concept. Namely, a change in specifications from density-based to stiffness-based would be necessary. Additionally, valid approaches to extract properties of the surface layer are needed. The results from projects tested indicate the most promising approaches to using this technology are for evaluating uniformity, compaction monitoring (determining when to stop rolling), and proof rolling. The proof rolling application requires validation to determine the depth of the weak spot.

Comparison of Stress States and Paths: Vibratory Rollermeasured Soil Stiffness and Resilient Modulus Testing
Robert V. Rinehart, John R. Berger and Michael A. Mooney, Colorado School of Mines
Paper Number: 09-3582
From: Abstract
Vibratory roller-based measurement of soil stiffness during intelligent compaction and continuous compaction control has the potential for performance based quality assurance of unbound materials. To realize this potential, the relationship between the roller-measured soil stiffness and the soil modulus, particularly resilient modulus, must be understood. This paper compares the in-situ stress states and paths experienced by soil beneath a vibratory roller with stress states/paths during laboratory resilient modulus testing. Observed stress fields within the 1 m depth of influence varied considerably for both vertically homogeneous embankment soil and layered base over subgrade conditions. During low excitation force vibration, roller induced levels of deviator stress were notably greater than those used during laboratory resilient modulus testing, while levels of mean stress were less. Predicted modulus variation with depth is strongly influenced by modulus function parameters. Using typical granular soil parameters, modulus was found to be constant with depth for the embankment conditions. With modulus parameters of more fine-grained behavior, modulus increased considerably with depth.

Software and Processes for Intelligent Compaction Data Analysis
Timothy Anderson and Rebecca A. Embacher, Minnesota Department of Transportation; Andrew J. Graettinger, University of Wisconsin, Madison; Jeff Morgan, Compnet Concepts; D. Lee Petersen, CNA Consulting Engineers.

Paper Number: 09-3553

From: Abstract

The Minnesota Department of Transportation (Mn/DOT) implemented intelligent compaction (IC) for unbound materials on a construction project contractual basis on four projects during the 2007 construction season. In 2008, one 2007 project continues and two additional unbound material projects and one hot-mix asphalt are were completed. Previous experience illustrated that quality control, quality assurance and research activities were problematic using the software provided by the roller manufacturers. The manufacturer' software is proprietary, expensive, subject to change, and generally did not provide the functionality required by Mn/DOT. Hence, the Department chose to develop software and processes fitting their specific needs. The work included development of database structures for managing and archiving IC data; software to import and validate IC data, populate the database and write geographic information system (GIS) shape files; processes and tools to manage, display and evaluate IC data within ArcInfo GIS software. Intelligent compaction generates vast amounts of data, which required special handling. The end product is equally suited to compaction of both unbound and bound materials used to construct the entire flexible pavement structure. This paper reports the target functionality, terminology, geodatabase structure, import and filtering software and ArcInfo geographic information system (GIS) platform processes.